

**WHAT IS CLAIMED IS:**

1. A simulator for a chemical mechanical polishing process for planarizing a semiconductor substrate, said simulator receiving:

5 a pattern density data containing information about a pattern density per unit region of a fabrication pattern in a pattern forming process of a semiconductor device; and

first and second measured data about height distributions of irregularities on said semiconductor substrate that are measured before and after a chemical mechanical polishing process executed with respect to said pattern forming process,

wherein said first measured data is compared with a first calculated data about a two-dimensional distribution of irregularities on said semiconductor substrate before said chemical mechanical polishing process which is calculated from said pattern density data, a least squares analysis is performed to obtain a first correlation coefficient, and a parameter fitting is performed such that square of said first correlation coefficient becomes a maximum, and

said second measured data is compared with a second calculation data about a two-dimensional distribution of irregularities on said semiconductor substrate after said chemical mechanical polishing process which is calculated from said pattern density data, a least squares analysis is performed to obtain a second correlation coefficient, and a parameter fitting is performed such that square of said second correlation coefficient becomes a maximum.

2. The simulator according to claim 1, comprising:

25 a pattern density two-dimensional distribution calculating part that receives said

pattern density data, expands said pattern density data in two dimensions based on a coordinate data, and outputs it as a pattern density two-dimensional distribution image ;

5 a first height distribution calculating part that obtains said first calculated data by executing an operation of multiplying a pattern density at individual parts of said pattern density two-dimensional distribution image by a thickness of a laminated film laminated on said pattern density two-dimensional distribution image;

a Fourier calculating part that performs a Fourier transform of said pattern density two-dimensional distribution image and outputs a two-dimensional Fourier image;

10 a spatial filter part that subjects said two-dimensional Fourier image to a spatial filter such that only a component having a predetermined spatial frequency passes through;

a reverse Fourier calculating part that subjects said two-dimensional Fourier image after being subjected to said spatial filter to a reverse Fourier transform and outputs a two-dimensional reverse Fourier image ; and

15 a height distribution calculating part that obtains said second calculated data by executing an operation of multiplying a pattern density at individual parts of said two-dimensional reverse Fourier image by said thickness of said laminated film laminated on said two-dimensional reverse Fourier image.

20

3. The simulator according to claim 2 further comprising:

a mesh adjusting part for sampling meshes of said first and second measured data so as to match the mesh of said pattern density two-dimensional distribution image.

25

4. The simulator according to claim 2, further receiving:

a third measured data about a height distribution of irregularities of an under laid layer of said fabrication pattern which is measured before forming said fabrication pattern, and further comprising:

first and second measured data adding parts that add said third measured data to  
 5 said first and second calculated data, respectively.

5. The simulator according to claim 4 further comprising:

a mesh adjusting part for sampling meshes of said first, second and third measured data so as to match said mesh of said pattern density two-dimensional  
 10 distribution image.

6. The simulator according to claim 1 comprising:

a pattern density two-dimensional distribution calculating part that receives said pattern density data, expands it in two dimensions based on a coordinate data, and outputs  
 15 it as a pattern density two-dimensional distribution image ;

a height distribution calculating part that obtains said first calculated data by executing n operation of multiplying a pattern density at individual parts of said pattern density two-dimensional image by a thickness of a laminated film laminated on said pattern density two-dimensional distribution image; and

20 a CMP image calculating part that obtains said second calculated data by (i) calculating, based on said first calculated data, a two-dimensional distribution image of a polishing pad in a state that said polishing pad used in said chemical mechanical polishing process of said laminated film is pressed against said laminated film, (ii) calculating a two-dimensional distribution image of stress exerted on said polishing pad based on said  
 25 two-dimensional distribution image of said polishing pad, and (iii) calculating a

two-dimensional distribution image of irregularities after polishing said laminated film based on said two-dimensional distribution of said stress.

7. The simulator according to claim 6, further receiving:

5           a third measured data about a height distribution of irregularities of an under laid layer of said fabrication pattern which is measured before forming said fabrication pattern, and further comprising:

          a measured data adding part that adds said third measured data to said first calculated data.

10

8. The simulator according to claim 6 further comprising:

          a mesh adjusting part for sampling meshes of said first and second measured data so as to match said mesh of said pattern density two-dimensional distribution image.

15           9. The simulator according to claim 7 further comprising:

          a mesh adjusting part for sampling meshes of said first, second and third measured data so as to match said mesh of said pattern density two-dimensional distribution image.